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U.S. FOREST SERVICE AND NATIONAL PARK SERVICE
WILDERNESS AIRCRAFT OVERFLIGHT STUDY:
SOCIOLOGICAL BACKGROUND AND STUDY PLANS

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INTRODUCTION

This paper presents the background and sociological aspects of the combined U.S. Forest Service and National Park Service Wilderness Aircraft Overflight Study (WACOS). The paper presented at this conference by Harrison (ref. 1) discusses the acoustical considerations of the WACOS and is a companion piece to this paper. The WACOS broaches a new area of research by combining aspects of outdoor recreation sociology and aircraft noise response studies. The tasks faced by this study create new challenges and require innovative solutions.

Background information on the WACOS is presented in this paper, with special emphasis on sociological considerations related to the study. At the time of this writing, no data have yet been collected, so this paper will present background information, related issues, and plans for data collection. Some recent studies indicate that managers of Forest Service wildernesses and National Park Service areas consider aircraft overflights to be a problem to their users in some areas. Additional relevant background research from outdoor recreation sociology is discussed, followed by presentation of the authors' opinions of the most salient sociological issues faced by this study. The goals and desired end products are identified next, followed by a review of the methods anticipated to be used to obtain these results. Finally, a discussion and conclusion section is provided.

LITERATURE REVIEW

To some, the issue of aircraft flying over national parks and wildernesses may not seem worthy of substantial consideration. There are several indicators, however, that aircraft overflights are a major problem for the recreating public in at least some areas.

Many outdoor recreation studies have considered the demographic characteristics, activity patterns, travel patterns, motivations, conflicts, and even long-range projections of recreation use and users. While extensive research has been completed on the effects of aircraft overflights on urban populations in the vicinity of airports, a detailed literature review (ref. 2) revealed a shortage of information on the subjects of en route aircraft sound, aircraft sound in wilderness settings, or the acoustic effects on a park or wilderness visitor population. The WACOS, therefore, is breaking new ground, and we must rely on research in related areas as there is none directly related to the topic at hand. Presented below is a brief synopsis of the available literature in topics of interest with some relationship to the Wilderness Aircraft Overflight Study.

Wilderness Managers' Views of Aircraft Overflights

A review of four surveys of wilderness unit managers conducted over the last 7 years (ref. 3) identified the cumulative rank order responses for the significance of external threats (human activities outside the area boundaries which degrade valued characteristics of nature) to wilderness areas. Military operations, namely overflights, were ranked first among all threats listed, with airborne pollution ranking a close second. The "military operations" category may be somewhat misleading in that it refers primarily to military aircraft overflights, and some respondents may have included commercial or private air traffic within the air category (ref. 3).

A study of Forest Service managers of wilderness areas (excluding Alaska) was conducted by the Forest Service in the fall of 1988. Responses were received for 90 percent (282/314) of the wilderness areas sampled. Of the 282 wilderness areas for which responses were obtained, 152 areas (53.9 percent) identified a concern in one or more categories of aircraft overflights. Wilderness managers identified 130 wilderness areas (46.1 percent) with no identified aircraft overflight problems. Some wildernesses near commercial airports were impacted by 12 to 13 aircraft overflights per hour! Wilderness managers perceived military overflights to be a greater problem in wilderness areas than other types of aircraft, even when there was less than one flight per day. Of the 152 areas with aircraft overflight problems, 93 (61 percent) indicated military aircraft were a problem. When considering those managers that indicated there were aircraft overflight problems even though they had less than one flight per day, 45 managers indicated that the problems were from military aircraft, 16 mentioned general aviation, while only 2 managers indicated that commercial aircraft were a problem.

Another study of Forest Service managers of districts containing officially designated wildernesses was conducted by the General Accounting Office in the spring of 1989 (ref. *). Although not specifically directed at overflight issues, some survey questions dealt with "aircraft transport" within Forest Service wildernesses. The data provided below indicate that the majority of wilderness district managers reported no aircraft transport during fiscal year 1988, but more than 7 percent of those managers able to respond to this question indicated that they had more than 25 aircraft transport occasions during that time. That study did not distinguish the type of aircraft transport, however (military, sightseeing, helicopter, en route aircraft, and so forth).

Number of Aircraft Transports	Number of Wilderness Ranger Districts
0	155
1 - 10	87
11 - 25	11
26 - 50	6
51 - 100	5
> 100	9
no basis to judge	20

*General Accounting Office, 1989. Survey of U.S. Forest Service Management of Wilderness Areas. unpublished study conducted by the GAO, spring 1989.

Additionally, that study found that 24.6 percent (71/289) of reporting districts said that air transport (helicopters or airplanes) was specifically allowed in this wilderness by either the legislation that enacted that wilderness or in the Wilderness Act of 1964, as of September 30, 1988. Also, 7 percent (15/215) of reporting districts said that airfields or heliports existed legally or illegally in the portion of the wilderness within their district. (See footnote, preceeding page.)

Another indicator of the severity of the problem of aircraft overflights of national parks and Forest Service wildernesses is given by the establishment of advocate groups who are trying to modify, reduce, or prevent overflights of rural areas, including parks and wildernesses. "SKYGUARD," located in Reno, Nevada, is one such group. SKYGUARD is a grass roots organization born during a 1986 "Save Our Skys" conference sponsored by the the Rural Coalition and Citizen Alert organizations, which included environmental leaders of the West and experts on military airspace issues. Representatives from most western states were present at that conference. The idea for SKYGUARD's toll free telephone number (1-800-759-4827) was developed during that conference to enhance communications among people and organizations that perceived problems with military aircraft overflights. Although not originally a major function of the organization, SKYGUARD has become a national clearinghouse of aircraft overflight technical information, and complaints related to those overflights *

"Close encounters with military overflights are occurring with increasing frequency due to DOD changes in defense strategies which emphasize low-level altitude flight training" (ref. 4). The FAA recommends that pilots--both civilian and military--not fly below 2,000 feet in national parks and Forest Service wildernesses, but the agency's advisory does not carry the force of law.

From the information presented above, there are indications that aircraft overflights of Forest Service wildernesses and national parks are a problem in at least some areas. Few scientific studies have been conducted where the visiting public was contacted in a systematic fashion. Recently, however, public concern over the issue of aircraft overflights of national parks and Forest Service wildernesses led to creation of Public Law 100-91 in 1987. In response to that law, the Forest Service and National Park Service are jointly participating in an interagency study of aircraft overflights to assure compatibility of study results and maximize cost effectiveness. The primary study goal is to "perform research to define the relationship between aircraft overflights of Forest Service wilderness and National Park Service areas and effects on visitors and resources."

Wilderness Users--a Brief Background

Outdoor recreation sociology is a fairly new science, with the first major scientific studies being conducted for the Outdoor Recreation Resources Review Commission in the early 1960s (ref. 5). Since that time, there have been many studies of users of national parks and wilderness areas.

A summary of the available research on wilderness users (ref. 6) showed that wilderness users come from a variety of backgrounds and recreate in a

* Bukowski, Grace. 1989. Personal communication with representative from SKYGUARD, P.O. Box 5391, Reno, NV 89513, (1-800-759-4827) on September 5, 1989.

variety of ways; however, some generalities can be made. Wilderness visitors are primarily young adults, males, highly educated, have professional or technical occupations, moderately high incomes, and are predominantly from local or regional areas. These visitors have low membership in conservation organizations, are urban residents, have considerable previous experience, and most often come in family groups. Wilderness recreation use is distributed unevenly among areas, within areas, and over time. Parties typically are small; most often use the wildernesses without outfitters; stay only a short time (a few hours or a few days); and engage in multiple activities, with hiking, fishing, and photography being the most common.

It is important to recognize the differences between the typical situation encountered by respondents to community airport noise studies and the typical wilderness recreation experience that will be studied in the WACOS. In a community noise study, the respondent reports the acoustic environment he or she has become accustomed to over a long period of time at his or her residence. In a wilderness recreation setting, the situation is quite different. The respondent is in a possibly unfamiliar environment, and is there for only a short period of time--perhaps as little as a couple of hours, or perhaps as long as a few days. Considerably more effort and expense is required to have a wilderness recreation experience than to stay at home. The recreationist must set aside sufficient leisure for the visit, arrange for transportation, usually make arrangements with others to accompany him, acquire any needed equipment, and develop plans for a recreational experience. Therefore, there is a much higher opportunity cost in terms of an investment in time, equipment, and personal resources for even a short wilderness visit than to simply stay at home. One might theorize, therefore, that recreationists would be more critical of any sort of detractors from their wilderness visit than they would be at home. On the other hand, because the recreationist is only at the wilderness area for a short time, perhaps coping mechanisms would allow him or her to simply put up with annoying aircraft overflights, where in a residence setting that same person might choose to take action to reduce or remove the annoyance.

Noise in Remote Recreational Settings

One of the only publications on recreationists' reaction to noise (ref. 7) included aircraft noise. The central thesis of that publication is that people's acceptance of noise in a recreation environment is in large part determined by the character of recreation resource. That article describes the Outdoor Recreation Opportunity Spectrum, which establishes a gradient of characteristics of outdoor recreation lands, from primitive to urban areas. Along this gradient, acceptability of human-made noise varies with the character of the recreation opportunity, with human-made noise being less acceptable in the more primitive settings, such as wilderness areas and remote portions of national parks. The sounds in primitive recreation areas are primarily natural background sounds (such as wind or water), and both mechanical and unnatural nonmechanical sounds are inappropriate.

People who choose a particular type of recreation opportunity (primitive, modern, and so forth) probably hold somewhat similar notions of what is appropriate and in keeping with these kinds of places (ref. 7). Some of these notions become widely and strongly held norms that govern behavior and set

standards of appropriateness and acceptability in a specific setting far more effectively than agency regulations. Consequently, standards of acceptability of the loudness, repetitiveness, or duration of sounds in recreation environments should be established only in terms of the Outdoor Recreation Opportunity Spectrum.

Three researchers propose that a person's expectations modify the acceptability of noise levels--a person with experience in a particular area would have more realistic and strongly held expectations than a novice (ref. 7). Those authors also propose that two personal characteristics of a listener may also affect the impact of a given sound source on the listener--knowledge of the source's presence and attitude toward the source. If a listener has previous knowledge that the source will be emitting sounds, detection is more likely than if the source is completely unexpected. Additionally, the message of a sound may also influence its acceptability. For instance, hikers likely would not be bothered if they were to hear other hikers chatting. But, if they heard motorcycles--or other hikers who were screaming and yelling--they probably would be bothered to a significant extent (ref. 7).

Sounds, then, only become unacceptable according to the criterion of appropriateness within a specified opportunity, rather than at any absolute level. By this logic, recreationists in a primitive area such as a wilderness or remote portion of a national park who held expectations of a quiet environment would find even the faintest sound at any time from a chain saw, motorcycle, or airplane to be a disruption of their recreation experience.

UNIQUE SOCIOLOGICAL ISSUES

The WACOS provides the opportunity to combine two areas of research for the first time. Therefore, this research will set precedents in definitions of terms, selection of appropriate metrics, and methods used for data gathering. Additionally, a number of sociological issues may be important in determining recreationists' reaction to aircraft overflights, but it is not yet known which of these issues is most important. Therefore, all of these issues should be considered in the design of this research. These issues are discussed in turn below.

"Special Places" and Off-Site Users

"A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain" (Public Law 88-577, the 1964 Wilderness Act).

Wilderness areas and national parks are special places. National parks have been called "Crown Jewels" of the country. Wilderness areas are intended to remain "untrammelled by man" in perpetuity. Many visitors specifically seek out these areas precisely because of their pristine nature. Therefore, because of the special character of these lands, users of these areas may place even more stringent levels of acceptability of intrusions by man than for other recreation areas or possibly even their home environments. Additionally, there

are "off-site users" who may not even visit the areas, but may respond to newsletters or articles from environmental organizations by taking action such as writing their political leaders to solve problems they may have never personally encountered.

Satisfaction/Annoyance

There are many reasons for establishment and maintenance of parks and wildernesses beyond recreational use of these areas. These reasons include: preservation of ecosystems and gene pools, scientific values, educational values, social values, and even commercial values. But, of major consideration to managers of wildernesses and parks is the satisfaction of the visiting public.

Unlike community aircraft noise studies where the dependent variable of interest is generally "percent highly annoyed," recreation studies often consider "percent highly satisfied." The merging of these two fields and concepts raises the issue of the appropriate sociological dependent variable--percent highly annoyed or percent highly satisfied. Should we strive for a low level of annoyance or a high level of satisfaction? This is a policy level decision, beyond the scope of this paper, but nonetheless an issue which must be resolved before additional extensive research is conducted in this area.

Additionally, rather than measure annoyance or satisfaction, perhaps other measures of the impact of aircraft overflights on park/wilderness visitors should be considered in the WACOS. These metrics include detectability (audibility by a person actively listening for aircraft), noticeability (audibility by a person not engaged in active listening for aircraft), intrusion (interference in a recreational activity, caused by aircraft overflights), annoyance (as used in conventional airport noise studies), and/or a behavioral response (such as leaving the area, complaining to authorities, taking some measure to modify or reduce the overflights, or not returning to the area because of the overflights).

When to Measure Impacts?

Another difference between the WACOS and conventional aircraft annoyance studies is a temporal one. In community studies, residents are asked about the long-term effects of the aircraft overflights on their level of annoyance. But people recreating in wildernesses and parks are, by definition, visitors who may or may not choose to return. There are four time periods of interest when aircraft impacts may be of importance to the WACOS: (1) at the time of the overflight; (2) at the conclusion of the trip, when an evaluation of the entire experience is being made; (3) at home, when the impacted individual is presenting an evaluation of the experience to others; or, (4) when a decision is being made to return to that area or choose another area for their next trip. There are valid reasons for considering each of these response measurement periods, but a decision as to which (if any) is most important has not been made at the time of this writing.

Transient Population and Frame of Reference

Most studies of reactions to aircraft noise are related to one's home environment. Respondents to these studies are faced with an acoustic environment with a relatively regular pattern of aircraft noise over an extended period of time. In a wilderness or park setting, people are nearly always visitors, staying only a short period of time, and in many cases are at the new location for the first time. These individuals have a different frame of reference. Because of the lack of previous studies of the reaction of transient populations to aircraft noise, we do not know what frame of reference these individuals are using. They may be comparing the acoustic environment with their residence or place of employment, or may be comparing it to other parks or wildernesses they have visited in the past, or even comparing the real-world environment to one they have imagined as the idealized wilderness environment, devoid of any evidence of the modern world.

Motivations

Motivations are an important topic in outdoor recreation sociology, and are of critical importance in determining if the recreational opportunities provided are meeting the needs of the people that are using the areas. The motivations for coming to a national park or wilderness area are many and varied. The more common motivations can be categorized as: sharing enjoyment with others; escape; seeking a sense of competence, self-esteem, or achievement of self-worth; or a desire to be in pleasant surroundings (ref. 8).

It is important to accept that these reasons are all valid uses of natural environments, but that one's motivations can change from one recreation experience to another, or even during the same recreation experience. An individual's motivations for coming to a wilderness area or park are a central issue for the WACOS, because an individual's motivations will likely influence their perception of the environment they encounter and thus modify their level of satisfaction (or the annoyance) with the recreational environment. For example, someone seeking to participate in rowdy activities with their companions may not place much emphasis on the characteristics of the environment and may not even notice aircraft overflights, while at another time that same person may be seeking escape from civilization to consider some spiritual question, and even a single aircraft overflight might ruin their experience.

Social Environment

The large majority of outdoor recreational experiences occur in a social setting. It has been shown that the individuals with whom one recreates influence one's recreational patterns and activities in an outdoor setting (ref. 9). It is likely that one's recreation partners influence an individual's reaction to a variety of attributes of a wilderness experience, including aircraft overflight noise. Social factors that may influence reaction include group size (which could affect the ambient noise level), experience and specialization level of group members, past experiences of group members, and strongly held opinions of influential group members.

Conflict

The study of conflict among recreationists is a common area of inquiry in outdoor recreation research. Several case studies have shown that conflicts arise between recreationists participating in specific activities, such as anglers and motorboaters, or hikers and horseback riders. One area of consideration for the WACOS is determination of possible conflict between aircraft overflights and specific types of recreationists. For example, wilderness visitors seeking solitude or enjoying wildlife photography may be highly impacted by aircraft overflights, while others seeking only a social experience may not be impacted at all.

Coping Behavior

Visitors to wildernesses often have a considerable investment in both time and money to reach these areas. It has been suggested, therefore, that these people may choose some type of coping mechanism to reduce annoyance from overflights, rather than let the intrusion interfere with the enjoyment of their visit. Such coping mechanisms could include: ignoring the overflights; justifying the overflights for a purpose they consider necessary; focusing on some aspect of overflights they may enjoy, rather than on the intrusion; or some other coping mechanism.

STUDY GOALS AND OBJECTIVES

The WACOS core team understands the legislation mandating this study to require the following primary study goal:

Perform research to define the relationship between aircraft overflights of Forest Service wildernesses and National Park Service areas and effects on visitors and resources.

Specific project objectives are as follows:

1. Determine the correlation between aircraft noise and visitor response in a wilderness/park setting.
2. Select the best methods considering the timelines and cost as well as a scientific merit for accomplishing study goals;
3. Identify the most important visitor responses to aircraft overflights and determine how they should be measured.
4. Identify the acoustic variables of greatest concern to visitors and the level of precision needed in the acoustic measurement program.
5. Describe the effectiveness of SFAR 50-2 in restoring the natural quiet at Grand Canyon National Park.
6. Identify any other impacts of overflights on sensitive resources (historic or prehistoric structures, wildlife, and so forth).

7. Develop a planning tool to assist field managers in assessing the impact of overflights on the park/wilderness environment.
8. Conduct lab or controlled studies as necessary to identify the most important aircraft noise/dose parameters.
9. Determine how the motivations and satisfactions of air tour passengers are related to those characteristics of flights which impact wilderness visitors.
10. Study the relationship between visitor safety and aircraft overflights.
11. Determine the impacts of sonic booms on wilderness users and park visitors.

Specific end products desired in the WACOS include: (1) a relative ranking of acoustic annoyances; that is, in a list of annoying sounds in wildernesses and parks, where do aircraft rank?; (2) an absolute ranking of aircraft overflight impacts; that is, what percentage of wilderness and park visitors are impacted by overflights either by an increase in annoyance or a decrease in levels of satisfaction; (3) a ranking of aircraft types by annoyance level; that is, in this rank, where do different types of aircraft fit (en route aircraft, sonic booms, military training flights, sightseeing aircraft, helicopters, general aviation, administrative flights, and others); (4) identification of annoying characteristics of aircraft overflights; that is, what characteristics of the sound are most bothersome (sonic booms, time above, LDN, detectability, tone, and so forth); (5) identification of recreational circumstances related to aircraft overflight annoyance, including social group, motivation, activity, time of day, presence of pack stock, and so forth.

METHODS

At the time of this writing, methods for obtaining the information desired have not been finalized. The study design will be finalized in consultation with the selected contract research team. The information provided below presents a preliminary discussion of methods likely to be used to gather the information required by this study, arranged chronologically.

The study is envisioned as a three-phased project, which is described in more detail in the following paragraphs. Most of the work will be devoted to determining the relationship between the aircraft noise environment and the response of park/wilderness users. The Forest Service final report will be completed by May 1991. The National Park Service final report is anticipated to be completed in 1993. To ensure consistency of results, the Forest Service and National Park Service have selected a single nationally known contract research team who will perform most of the work on a task-order basis. To ensure cost effectiveness, state-of-the-art white papers rather than original research will be used where costs are prohibitive, and smaller studies will be performed in-house or by other methods.

The first phase of the project is designed to finalize the overall study design and determine the range of responses of wilderness and park users to aircraft overflights. This phase will include study design meetings with experts in the field from acoustics, psychoacoustics, and wilderness sociology. A series of pilot tests will be conducted using questionnaires, acoustic measurements, focus groups, meeting with managers, participant observation, and possibly other techniques in a convergent validity framework. Information gained in this phase will assist development of later phases of the WACOS.

The second phase of the project is designed to assist in identification of the most important noise-dose parameters and visitor responses which should be subject to intensive field investigation. Since virtually no previous work has been accomplished in the field of investigation of aircraft overflight effects on dispersed recreationists in natural settings, there is a tremendous number of variables (aircraft type, aircraft altitude, aircraft use, aircraft sound characteristics, and visitor characteristics) which need to be investigated to perform the necessary analysis to define the relationship specified in the overall project goal outlined above. Due to high costs of field data collection, it is desirable to reduce the number of variables to be investigated in the field portion of the study. This work will be accomplished through lab and pilot studies.

The final phase of the WACOS consists of concurrent detailed sociological and acoustical field studies and preparation of final reports. In Forest Service wildernesses, this phase will be conducted during the summer and fall of 1990. It is anticipated that 10 to 20 Forest Service wildernesses will be studied. Forest Service data analysis, interpretation, and report writing will be done during the fall and winter of 1990, with the final Forest Service report to be due in May 1991. For National Park Service areas, this phase will likely be conducted in 1991 and possibly 1992.

At the time of this writing, plans are being finalized to conduct a pilot study at a wilderness area in the northern Rocky Mountains this fall to test a variety of methods for possible use in the primary field data collection in 1990 and to reduce the number of sociological variables of interest. This pilot study will investigate sociological and acoustic issues related to overflights. Sociological questions to be answered include identification of the range of possible responses the recreating public may have to overflights, what aspects of overflights create the most annoyance, and which social or activity circumstances are correlated with high levels of annoyance to aircraft overflights.

DISCUSSION/CONCLUSION

The Wilderness Aircraft Overflight Study provides an opportunity to advance both the fields of wilderness sociology and acoustics. While responding to the congressional legislation requiring this study, this research could also open new areas of investigation into the influence of the acoustic environment on recreationists' overall satisfaction level. Findings may help identify appropriate noise levels depending on the type of recreational setting--it is likely that in some recreational settings, such as amusement parks or dance

clubs, a high level of human-made sound enhances the recreational experience, while in remote wilderness settings any human-made sounds are considered an intrusion. Ultimately, it may be possible to use information obtained from this study and others that may follow to develop a better understanding of the importance of acoustics to recreation satisfaction and to improve the public's recreation environment. Additionally, further insights may be gained as to aircraft acoustic issues in rural areas, which could be important in developing future regulations related to military training routes, military operating areas, commercial flight paths, and general aviation regulations. Consideration of the importance of the ambient sound level and the transient nature of the populations in these areas may lead to new acoustic metrics and methods appropriate to future studies.

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